Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE PASSING OF THE FAHRENHEIT SCALE

By ALEXANDER McADIE
Director of the Blue Hill Observatory

Geographers may have noticed that in recent climatological work, and in all exploration of the atmosphere, temperatures are not given in Fahrenheit degrees but in degrees Absolute Centigrade. They will notice, too, that the familiar degree sign (°) is now omitted and reserved for degrees of angular measurement. Geographers have a right to ask why such changes are necessary.

The prime reason is that in exploring the upper air and in all work relating to the structure of the atmosphere, or *aërography,* the majority of the readings are below the zero of both the Centigrade and the Fahrenheit scales. This results in a multiplicity of minus signs. At a height of four kilometers and above, temperatures are below the zero of the Centigrade scale, even in mid-summer and even over the equator; and at a height of six kilometers the same is true for the Fahrenheit scale.

A second reason is that half the world, the larger half, uses the Centigrade scale; and the rest, except a small portion to be mentioned later, uses the Fahrenheit. In Germany and some other parts of Europe, a third scale is used, chiefly for domestic purposes, known as the Réaumur, with the ice point marked 0° and the steam point 80°; but this scale is so little used by scientific men that in the International Tables, no conversion tables are given. It is not necessary to give in detail the steps in the development of the thermometer from the crude instrument of Galileo and the form used by Sanctorius to modern standards, nor may we here discuss the evolution of thermometer scales. The Fahrenheit scale ran originally from 0° to 8°, the former being the lowest temperature then obtainable by artificial means and the latter being the temperature of the human body. Subsequently each degree was divided into 12 parts. Later the freezing point was marked 32° and the boiling point placed 180° higher and marked 212°. The zero of the present Fahrenheit scale is 459.4° above the so-called absolute zero or, to express it in other terms, the absolute zero or zero of no molecular motion is 491.4° F. below the freezing point of water.

There have been various temperature scales, one being that of Sir Isaac Newton, where the ice point was 0° and the temperature of the human body 12°. The original centigrade scale had the boiling point marked 0° and the freezing point 100° and was known as the Celsius. Linnæus reversed the order.

Now it will be conceded that if we are to use a zero or starting point it is advisable to use the ultimate rather than some intermediate value. There

is such an ultimate value in temperature, determinable in two ways, one known as the absolute thermodynamic method and the other as the hydrogen gas thermometer method. The latter, which is the adopted method, gives a coefficient of expansion such that we can express the zero as —273.02° C.; or the freezing point on the Centigrade scale is 273 degrees higher than this zero. If, then, we start with this zero there will be no need for minus signs; and largely for this reason physicists, chemists, and others have begun to use generally the Absolute Centigrade scale.

Many meteorologists hold that the Fahrenheit scale has one great advantage over both Centigrade and Absolute, in that, the scale division being smaller (nine divisions on the Fahrenheit corresponding to five on the Centigrade scale), it is possible to give readings with more definiteness. Some climatologists think that the Centigrade scale division is too large for their purposes; but as a matter of fact the errors of exposure are so much larger than errors of reading that the refinement seems unnecessary. Nevertheless, to meet the objections of meteorologists, climatologists, and others, the writer has proposed a new scale, a new absolute, which for want of a better name may be called the New. The starting point is the same as in the Absolute and is written 0. The freezing point is marked 1,000. The diagram herewith (Fig. 1) shows the readings on the four scales in close proximity so that the general relations can be readily grasped.

The scale divisions on the New scale are even smaller than the Fahrenheit and meet the problem of refinement of reading. Again, as in the Absolute scale, there are no minus signs. In the third place, there is a saving of figures in tabulating, printing, and even speaking, although at first

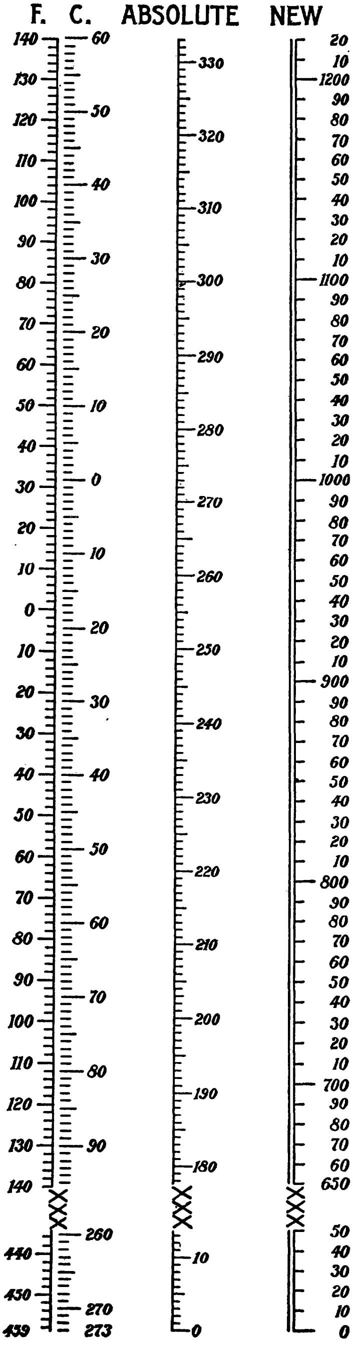

FIG. 1—Comparison of four thermometer scales, Fahrenheit, Centigrade, Absolute, and New.

glance this might not seem to be the case. Fourth, the New scale makes for accuracy in compilation, as an erroneous entry is more easily caught by the eye, and in the determination of mean values the larger units are of the same order.

Fifth, there is a fundamental distinction between *warm* and *cold,* which is shown by the range of one hundred divisions, all readings below 1,000 being *cold,* and all readings above 1,100 being *warm* (on the Fahrenheit scale these would be 32° (freezing) and 80° (summer heat).

Sixth, winter temperatures are more readily and definitely given, as e. g. —10.8° F., a not infrequent reading in many parts of our country in winter, becomes 915. In tabular work, only three pieces of type would be needed in place of eight.

Seventh, when it is very hot or very cold, the public wants the fullest details. Fine distinctions or graduations appeal to the imagination at such times, especially if conditions approximate a record. Given an extremely warm day, it could be described on the New scale as "eleven forty," 1,140; and an extremely cold day as "nine ten," 910. The equivalents are 100.6° F. and —12.1° F. and 38.3° C. and —24.6° C. respectively.

Finally, there is an educational aspect which is perhaps of more importance than all the preceding arguments. To the teacher, it is always difficult to explain, so that a class clearly grasps the relation, the law of Charles or yet again the characteristic equation of a pure gas. The fraction 1/273 is an awkward figure to remember and the student mind resents such a coefficient of expansion, which seems to him irregular and unnatural. When relations are not clearly comprehended, they are readily forgotten. The new scale makes for clearer conceptions of the nature and magnitude of temperature changes. It starts from a definite value, one that has a distinct physical meaning, and also makes use of that most familiar change of physical form, water to ice. If we could only introduce at the freezing point and at the boiling point some auxiliary extension tables giving the degrees of heat of fusion and evaporation, the so-called latent heats, then the whole conception of heat, the whole process of molecular change, the work-equivalent of heat and the heat-equivalent of work would take on a new aspect for the student.